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Datasheet for the decision of 4 March 2026

Case Number: T 0311/24 - 3.3.05

Application Number: 10814577.2

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Title of invention:
METHODS OF AGING ALUMINUM ALLOYS TO ACHIEVE IMPROVED BALLISTICS PERFORMANCE

Patent Proprietor:
Arconic Technologies LLC

Opponents:
C-Tec Constellium Technology Center S.A.S.
Constellium Valais SA (AG)
Constellium Rolled Products Ravenswood, LLC

Headword:
AGING ALUMINUM ALLOYS/Arconic Technologies

Relevant legal provisions:
EPC Art. 100(b), 83

Keyword:
Sufficiency of disclosure - undue burden (yes)

Decisions cited:

Catchword:

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Beschwerdekammern

Boards of Appeal

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Case Number: T 0311/24 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 4 March 2026

Appellants: (Opponents)	C-Tec Constellium Technology Center/Constellium Valais SA (AG, Ltd)/Constellium Rolled Products Ravenswood, LLC 725 Rue Aristide Berges/Route des Laminoirs 15/ Route 2 South 38341 Voreppe- FR/3960 Sierre - CH/ Ravenswood, WV 26164 - US
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Respondent: (Patent Proprietor)	Arconic Technologies LLC 201 Isabella Street Pittsburgh, PA 15212 (US)
Representative:	Lenzing Gerber Stute PartG von Patentanwälten m.b.B. Bahnstraße 9 40212 Düsseldorf (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 3 January 2024 concerning maintenance of the European Patent No. 2473643 in amended form.**

Composition of the Board:

Chair	R. Winkelhofer
Members:	S. Besselmann
	J. Roider

Summary of Facts and Submissions

I. The joint opponents' (joint appellants, hereafter "appellants") appeal is against the opposition division's interlocutory decision according to which European patent EP 2 473 643 B1 in amended form on the basis of the then auxiliary request 1 (filed on 21 November 2023) met the requirements of the EPC.

II. The patent in suit concerns methods of ageing aluminium alloys to achieve improved ballistics performance.

III. Claim 1 as maintained by the opposition division (now main request) is identical to claim 1 as granted and reads as follows:

"*A method of aging aluminum alloys to achieve improved V50 FSP performance comprising:*

selecting a minimum V50 FSP performance level at a given areal density as a ballistics performance criterion for an aluminum alloy product; and

producing the aluminum alloy product, wherein the aluminum alloy product realizes a V50 FSP performance at the given areal density measured according to MIL-STD-662F(1997) that is at least as good as the minimum V50 FSP performance level, and wherein the producing step comprises:

preparing the aluminum alloy product for aging; and

underaging the aluminum alloy product an amount sufficient so that the minimum V50 FSP performance level is achieved, wherein the V50 FSP performance

is better than that of a peak strength aged version of the aluminum alloy product."

IV. Claim 1 of auxiliary request 7a, which directly follows the main request according to the sequence finally chosen by the patent proprietor (respondent), differs from claim 1 of the main request in that the following combination of features is added at the end of the claim:
"*, wherein the peak strength relates to the aluminum alloy product's tensile yield strength in longitudinal direction; and*
wherein the aluminum alloy product comprises 7085 aluminum alloy."

V. Claim 1 of auxiliary request 1 differs from claim 1 of the main request in that the following feature is added at the end of the claim:
"*; and wherein the aging comprises artificially aging.*"

Claim 1 of auxiliary request 2 differs from claim 1 of the main request in that the following feature is added at the end of the claim:
"*; and wherein the aluminum alloy product comprises 7XXX aluminum alloy.*"

Claim 1 of auxiliary request 3 differs from claim 1 of the main request in that the following feature is added at the end of the claim:
"*; and wherein the aluminum alloy product comprises 7085 aluminum alloy.*"

Claim 1 of auxiliary request 4 differs from claim 1 of the main request in that the wording "*as a ballistics performance criterion*" is amended to read "*as ballistics performance criteria*".

Claim 1 of auxiliary request 4a differs from claim 1 of the main request in that the following feature is added at the end of the claim:
"*, wherein the peak strength relates to the aluminum alloy product's tensile yield strength in longitudinal direction.*"

Claim 1 of auxiliary request 4b combines the amendments of the respective claim 1 of both auxiliary requests 4 and 4a.

Claim 1 of auxiliary request 5 combines the amendments of the respective claim 1 of both auxiliary requests 1 and 4.

Claim 1 of auxiliary request 5a combines the amendments of the respective claim 1 of both auxiliary requests 1 and 4a.

Claim 1 of auxiliary request 5b combines the amendments of the respective claim 1 of each of auxiliary requests 1, 4 and 4a.

Claim 1 of auxiliary request 6 combines the amendments of the respective claim 1 of both auxiliary requests 2 and 4.

Claim 1 of auxiliary request 6a combines the amendments of the respective claim 1 of both auxiliary requests 2 and 4a.

Claim 1 of auxiliary request 6b combines the amendments of the respective claim 1 of each of auxiliary requests 2, 4 and 4a.

Claim 1 of auxiliary request 7 differs from claim 1 of auxiliary request 4 in that the following feature is added at the end of the claim:
"*; and wherein the aluminum alloy product comprises 7085 aluminum alloy.*"

Claim 1 of auxiliary request 7b differs from claim 1 of auxiliary request 4b in that the following feature is added at the end of the claim:
"*; and wherein the aluminum alloy product comprises 7085 aluminum alloy.*", i.e. it combines the amendments of the respective claim 1 of both auxiliary requests 7 and 7a.

VI. The following documents are relevant here:

D10 ASM Specialty Handbook "Aluminum and Aluminum Alloys", ASM International, 1998, pages 311-315

D12 Registration Record Series Teal Sheets, The Aluminum Association, 2006, 7XXX alloys

VII. The respondent's arguments relevant to the present decision can be summarised as follows.

The invention was sufficiently disclosed. It was common general knowledge to determine an ageing curve. Only a single ageing curve was needed. The skilled person could thus apply the key teaching of the patent in suit that underageing of aluminium alloy products substantially improved the V50 FSP performance. The V50 FSP performance could be correlated to the amount of underageing. The skilled person could then select the minimum V50 FSP performance and the amount of underageing on the basis of that correlation, as was explained in paragraph [0007] of the patent in suit.

This applied all the more to auxiliary request 7a, which was limited to the alloy type used in Example 1, and for which V50 FSP data and yield strength data were available.

VIII. The appellants' arguments are reflected in the reasons for the decision.

IX. The appellants request that the decision under appeal be set aside and amended such that the patent is revoked.

The respondent requests that the appeal be dismissed (main request), or that the patent be maintained on the basis of one of auxiliary requests 7a, 1-7, 4a-6a and 4b-7b, all filed with the grounds of appeal.

Reasons for the Decision

Main request

1. Sufficiency of disclosure

1.1 Claim 1 relates to a method of ageing aluminium alloys to achieve improved V50 FSP performance, the V50 FSP performance being the velocity at which there is a 50% probability that an FSP (fragment simulation) projectile will completely penetrate the plate for a given areal density (paragraph [0010] of the patent in suit). To carry out the claimed method and to achieve the claimed technical effect, i.e. the improved V50 FSP performance, it is required, *inter alia*, to select a minimum V50 FSP performance level at a given areal density (hereafter "minimum V50 FSP") and to produce an

aluminium alloy product which has at least said minimum V50 FSP, by a producing step which comprises underageing. Said V50 FSP is to be better than that of a peak strength aged version.

1.2 For the present context, it can be assumed - in the respondent's favour - that the peak strength is the peak tensile *yield* strength in the longitudinal direction (col. 11 of the patent in suit in relation to Figure 4; examples), even though this is not specified in the claim.

1.3 It was common ground between the parties that the skilled person knows how to determine an ageing curve showing the parameter of interest (e.g. the yield strength) as a function of the ageing time at a given ageing temperature, as shown in Figure 23(c) of D10. This provides the skilled person with the peak yield strength of that ageing curve. Accordingly, underageing is obtained in that part of the ageing curve which relates to a duration less than that required for peak yield strength (see also paragraph [0006] of the patent in suit).

1.4 According to the respondent, this knowledge enabled the skilled person to carry out the claimed invention, making use of the key finding taught in the patent in suit that underageing of aluminium alloy products substantially improved the V50 FSP performance of such products, such that it was better than that of a peak strength aged version (paragraph [0004]). Specifically, the skilled person only needed a single ageing curve which they could then use to determine V50 FSP performance at peak strength and at data points in the underaged region to carry out the claimed method on this basis. This was shown in Figure 4 of the patent in

suit. There was thus neither a need to determine the maximum peak strength among several ageing curves nor to identify a particular ageing curve. Instead, the described concept could be applied independently of the chosen ageing regime and independently of whether there had been a preliminary stretching step. The skilled person would have had no difficulty in determining alternative ageing curves showing the yield strength as a function of the ageing temperature at a given duration, or deducing such ageing curves from a plurality of time-dependent ageing curves measured at different temperatures. For instance, the skilled person could easily apply the concept of the invention to an ageing regime which involved two steps at different temperatures. In all the cases, the ageing curve enabled the skilled person to tailor the product. Specifically, as was explained in paragraph [0007] of the patent in suit, the V50 FSP performance could be correlated to the amount of underageing for various aluminium alloy product forms. Consequently, the V50 FSP performance could be selected in advance, and subsequent aluminium alloy products of that product form could be underaged a predetermined amount to achieve the selected V50 FSP performance based on the correlation (ibid.). The skilled person would have had no difficulty in determining the correlation, and could carry out the claimed method on the basis of this correlation. This was all that was required. In particular, there was no need to identify an absolute "optimum" among all possible ageing treatments. Moreover, the appellants had not provided any data showing that the invention did not work.

1.5 This is not persuasive.

The skilled person would indeed be able to measure the

V50 FSP resistance at several data points of an ageing curve, including at the peak yield strength of that curve and at conditions representing underageing according to that curve, to establish a correlation between ageing conditions and the corresponding V50 FSP for a given aluminium alloy product. The skilled person would, furthermore, also be able to then use said correlation to select a V50 FSP *within the range covered by that correlation* and produce the aluminium alloy product of the given type by the corresponding underageing condition *of that correlation*.

However, producing an aluminium alloy product by underageing such that it achieves a selected minimum V50 FSP performance *within the limits of a correlation established in advance* is not sufficient to carry out the claimed method, which more generally relates to selecting a minimum V50 FSP and then producing an aluminium alloy product which has at least said minimum V50 FSP by underageing. The claim is not limited to any specific correlation, nor are the available ageing treatments limited in any way (other than that underageing is to be performed), nor is it clear within which boundaries the V50 FSP may be selected.

The claim merely includes an indirect definition of the lower boundary for selecting the minimum V50 FSP, namely that the latter must be better than that of "a peak strength aged version of the aluminum alloy product". That "peak strength" is the highest (yield) strength achieved by a specific aluminium alloy product as determined via ageing curves (paragraph [0006] of the patent in suit). However, different ageing treatments (different temperatures or even combinations of steps at different temperatures; different stretch) result in different peak yield strengths (see

Figures 23(c) and 27 in D10). It is not specified whether the peak yield strength is to be determined on the basis of a single ageing curve, or whether this is to be understood in the sense of an absolute maximum among all possible ageing treatments. Even assuming that the "peak strength" is that of a single chosen ageing curve, as argued by the respondent, it is entirely open which ageing curve (e.g. which temperature) to choose. In either case, the skilled person is not taught how to determine the peak strength of an aluminium product under consideration, and thus the associated V50 FSP. Consequently, the skilled person cannot identify the lower boundary for selecting the minimum V50 FSP. At the same time, the claim does not specify any upper boundary, but is open in this regard. It may at most be assumed that an unreasonably high, unattainable V50 FSP is not encompassed. Nevertheless, the skilled person is left in doubt as to which V50 FSP to select as the target for a given aluminium alloy product they wish to produce using the claimed method, despite the stated purpose of achieving *improved* V50 FSP performance. While said selection of the minimum V50 FSP may merely be a mental step, it is nevertheless relevant for sufficiency of disclosure because the selected minimum V50 FSP governs the claimed step of producing the aluminium alloy product.

Assuming that the skilled person wishing to carry out the invention has nevertheless, i.e. without concrete guidance, selected a suitable minimum V50 FSP according to the first step of claim 1, they then need to provide a production process comprising underageing which results in at least that selected minimum V50 FSP. Again, the patent in suit provides no instructions on how to identify the sufficient amount of underaging (see the language of claim 1) for this purpose, i.e.

how to adjust the annealing temperature and/or duration and/or stretch in accordance with the selected V50 FSP, other than relying on a correlation, including its applicable limits, established in advance (see the respondent's line of argument mentioned above (point 1.4) and the explanation in paragraph [0007] of the patent in suit).

To illustrate this, on the basis of Figure 4 of the patent in suit - irrespective of whether it may be reproduced (see below) - it remains unknown whether and how a V50 FSP of, for instance, 4000 ft/sec selected in the first step of claim 1 may be obtained by underageing, as ultimately acknowledged by the respondent.

In fact, the patent in suit does not provide any single example that is sufficiently detailed for reproduction (for instance, no indication of stretch, ageing time and temperature in the examples section). This also applies to the results illustrated in Figure 4, in respect of which no such data are provided either (see also point 2.3 below). There is thus no demonstration of how the required underageing conditions may be derived from the minimum V50 FSP selected in the first step of claim 1, over the whole range claimed.

Any attempt to carry out the claimed method is limited to the availability of the relevant correlation, which however is still to be determined. This amounts to a circular definition. In fact, the skilled person would need to establish suitable correlations for all possible ageing treatments, involving combinations of possibly stretching and one or more steps at a selected temperature and/or duration and the variation thereof, to know which minimum V50 FSP performance levels they

can select, and how to carry out the underageing step accordingly. This would represent an undue burden for the skilled person. It requires a research programme and does not constitute a proper teaching.

It is therefore not decisive in this case that the appellants themselves did not provide experiments in which they attempted to reproduce the invention.

1.6 In conclusion, the skilled person would not be able to carry out the claimed method of ageing aluminium alloys to achieve a selected improved V50 FSP performance, even less across the whole scope claimed, contrary to the requirements of Articles 100(b) and 83 EPC.

Auxiliary request 7a

2. Sufficiency of disclosure

2.1 Notwithstanding the questions of whether this auxiliary request should be disregarded and whether the requirements of Article 123(2) EPC are met, this request does not overcome the objection under Article 83 EPC outlined in respect of the main request.

2.2 The respondent took the contrary view that auxiliary request 7a should lead to a different conclusion because the peak strength was more closely defined and because the method was limited to aluminium alloy 7085, which was the alloy type used in Example 1 of the patent in suit. Even without identically reproducing Figure 4, this example provided specific guidance for this alloy type, and in particular disclosed the relevant V50 FSP values.

2.3 However, the specified meaning of the term "peak strength" as the specified tensile yield strength has already been taken into account when dealing with the main request (see point 1.2).

Moreover, as indicated above, the patent in suit does not provide any experimental details that would allow the skilled person to reproduce Example 1. While it is specified that alloy type 7085 was used, its specific chemical composition within the alloy type 7085 ranges (see D12) is unknown. This uncertainty adds to the uncertainty which derives from the lack of experimental details. It is only stated in the patent that seven ageing conditions were generated, and that the underaged conditions involved natural ageing over at least three weeks before artificial ageing (see paragraph [0045]). However, there are no further details such as the temperature or duration of the artificial ageing step or steps, and it is unknown whether any stretching was involved. All these parameters, including the precise chemical composition, may affect the yield strength. While Figure 4 does provide several values of the respective tensile yield strength, the skilled person would be unable to reproduce the ageing curve shown in this figure with the associated V50 FSP values on the basis of the general indications in paragraph [0045] without undue burden. This would again require a research programme.

Example 1 of the patent in suit, which itself cannot be reproduced, cannot overcome the deficiencies outlined in respect of the main request.

Furthermore, even if the exemplary V50 FSP values mentioned in the context of Example 1 were considered attainable, this does not change the conclusion that it

is again unclear within which boundaries the V50 FSP may be selected across the whole scope claimed, i.e. for all possible alloy 7085 compositions and product forms, and how the skilled person could then derive the corresponding underageing conditions to obtain the selected minimum V50 FSP. The essence of the reasoning remains the same as set out for the main request. It is again the case that any attempt to carry out the claimed method would be limited to the availability of the relevant correlation, which however is still to be determined, and this for all possible compositions of alloy 7085. This again requires a research programme.

2.4 In conclusion, auxiliary request 7a is not allowable either.

Auxiliary requests 1-7, 4a-6a and 4b-7b

3. Sufficiency of disclosure

3.1 None of the amendments in these auxiliary requests (see point V. above) changes the conclusions regarding sufficiency of disclosure.

The only amendments which, according to the respondent, were to respond to the objections of insufficiency of disclosure were the insertion of the feature "*where the peak strength relates to the aluminum alloy product's tensile yield strength in the longitudinal direction*" in auxiliary requests 4a-6a and 4b-7b and - as outlined in view of auxiliary request 7a - the limitation of the alloy type to alloy 7085 used in an example.

However, said meaning of the term "peak strength" as the specified tensile yield strength has already been

taken into account when dealing with the main request (see point 1.2) and accordingly when dealing with auxiliary request 7a (see point 2.3); the limitation of the alloy type also concerned auxiliary request 7a, as indicated.

3.2 Consequently, the same reasoning as outlined in respect of the main request applies, bearing in mind the additional considerations regarding auxiliary request 7a.

3.3 None of auxiliary requests 1-7, 4a-6a and 4b-7b is allowable either.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar: The Chair:

L. Gabor R. Winkelhofer

Decision electronically authenticated